

**OROVILLE FERC RELICENSING
(PROJECT No. 2100)**



**INTERIM REPORT
SP-F3.2 TASK 2
SP-F21 TASK 1**

**APPENDIX A
MATRIX OF LIFE HISTORY AND HABITAT REQUIREMENTS FOR
FEATHER RIVER FISH SPECIES**

**LITERATURE REVIEW OF LIFE HISTORY AND
HABITAT REQUIREMENTS FOR
FEATHER RIVER FISH SPECIES**

SPLITTAIL

JANUARY 2003

Element	Element Descriptor	General	Feather River Specific
General			
common name (s)	English name (usually used by fishers and laypeople).	Sacramento splittail	
scientific name (s)	Latin name (referenced in scientific publications).	<i>Pogonichthys macrolepidotus</i> The Sacramento splittail is the only member of its genus; a second species, <i>P. ciscoides</i> , is now extinct (U.S. Fish and Wildlife Service 1995).	
taxonomy (family)	Common name of the family to which they belong. Also indicate scientific family name.	Minnows – <i>Cyprinidae</i>	
depiction	Illustration, drawing or photograph.		
range	Broad geographic distribution, specifying California distribution, as available.	Sacramento splittail were historically found as far north as Redding, California, but are no longer found in this area. Sacramento splittail have been collected	In wet years, Sacramento splittail may migrate up the Sacramento River as far as the Red Bluff Diversion Dam and into the lower Feather and American rivers (Moyle 2002).

Element	Element Descriptor	General	Feather River Specific
		<p>from the Merced River at Livingston and from the San Joaquin River at Fort Miller. There are reported catches from the southern San Francisco Bay and at the mouth of Coyote Creek in Santa Clara County, but recent surveys indicate that splittail are no longer present in these locations (U.S.Fish and Wildlife Service 1995).</p> <p>On the San Joaquin River, Sacramento splittail may be found as far as Salt Slough (Moyle 2002).</p> <p>In most years, Sacramento splittail are confined to the Delta, Suisun Bay, Suisun March, lower Napa River, and lower Petaluma River (Moyle 2002).</p> <p>Important Sacramento splittail spawning areas include Sutter and Yolo Bypasses on the Sacramento River and also the Tuolumne River (Moyle 2002).</p> <p>Except when spawning, Sacramento splittail are largely absent from the Sacramento River (U.S. Fish and Wildlife Service 1995).</p>	<p>Sacramento splittail enter the lower reaches of the Feather River on occasion, and records indicate that they had been collected as far upstream as Oroville (U.S. Fish and Wildlife Service 1995).</p> <p>Captures of larval Sacramento splittail indicate that an important spawning area may be in the Sacramento River between the mouths of the American and Feather rivers (U.S. Fish and Wildlife Service 1995).</p>
native or introduced	If introduced, indicate timing, location, and methods.	Sacramento splittail are endemic to California (Moyle 2002).	

Element	Element Descriptor	General	Feather River Specific
ESA listing status	Following the categories according to California Code of Regulations and the Federal Register, indicate whether: SE = State-listed Endangered; ST = State-listed Threatened; FE = Federally listed Endangered; FT = Federally-listed Threatened; SCE = State Candidate (Endangered); SCT = State candidate (Threatened); FPE = Federally proposed (Endangered); FPT = Federally proposed (Threatened); FPD = Federally proposed (Delisting); the date of listing; or N = not listed.	Sacramento splittail was listed as a threatened species (FT) in February 1999 by the U.S. Fish and Wildlife Service (Moyle 2002).	
species status	If native, whether: Extinct/extirpated; Threatened or Endangered; Special concern; Watch list; Stable or increasing. If introduced, whether: Extirpated (failed introduction); highly localized; Localized; Widespread and stable; Widespread and expanding.	Sacramento splittail are native to California and their status is threatened (Moyle 2002).	
economic or recreational value	Indicate whether target species sought for food or trophy. Whether desirable by recreational fishers, commercial fishers, or both.	A small sport fishery exists for Sacramento splittail (Wang 1986). Anglers fish for Sacramento splittail in order to use them as bait for striped bass (Moyle 2002).	
warmwater or coldwater	Warmwater if suitable temperature range is similar to basses; coldwater if suitable temperature range is similar to salmonids.	Sacramento splittail is a warmwater fish.	

Element	Element Descriptor	General	Feather River Specific
pelagic or littoral	Environment: Pelagic - living far from shore; Littoral - living near the shore.		
bottom or water column distribution	Environment: bottom (benthic) or along water column.		
lentic or lotic	Environment: Lentic - pertaining to stagnant water, or lake-like; Lotic - moving water, or river-like.	Sacramento splittail prefer slow-moving sections of rivers and sloughs (Young et al. 1996).	
Adults			
life span	Approximate maximum age obtained.	<p>The lifespan of Sacramento splittail is 5 to 7 years, although larger fish may live to be 8 years old or older (Moyle 2002).</p> <p>The life span of the Sacramento splittail species is approximately five years (Caywood 1974).</p> <p>The lifespan of Sacramento splittail is 5 to 7 years (Caywood 1974; Meng et al. 1995).</p> <p>Sacramento splittail commonly live to five years of age (Sommer et al. 1997).</p>	
adult length	Indicate: Length at which they first reproduce; average length and maximum length the fish can attain.	<p>Adult Sacramento splittail measure 4.3 inches (110 millimeters) at the end of their first year, 6.7 inches (170 millimeters) at the end of their second year, 8.5 inches (215 millimeters) at the end of their third year, and grow about 1.4 inches per year (35 millimeters per year) thereafter. Sacramento splittail can reach over 15.7 inches (40 centimeters) in length (Moyle 2002).</p> <p>Males and females are mature by the end of their second winter, with minimum lengths of 7.1 to 7.9 inches (180-200 mm)</p>	

Element	Element Descriptor	General	Feather River Specific
		<p>(Daniels et al. 1983); occasionally males may mature by the end of their first year and females by the end of their third year (U.S.Fish and Wildlife Service 1995).</p> <p>Sacramento splittail can reach over 11.8 inches (300 millimeters) in length (U.S.Fish and Wildlife Service 1995).</p>	
adult weight	Indicate: Weight at which they first reproduce; average weight and maximum weight the fish can attain.		
physical morphology	General shape of the fish: elongated, fusiform, laterally compressed, etc.	<p>Sacramento splittail have an enlarged upper lobe of the tail, tiny barbels at the corners of the slightly subterminal mouth, a small head, and an elongated body (Moyle 2002).</p> <p>Sacramento splittail have pharyngeal teeth, which are hooked and have narrow grinding surfaces (U.S. Fish and Wildlife Service 1995).</p> <p>Adult Sacramento splittail develop a nuchal hump (U.S. Fish and Wildlife Service 1995).</p>	
coloration	Indicate color, and color changes, if any, during reproduction phase.	Sacramento splittail are silvery on their sides and become duller in color as they grow larger, and their back is usually dusky olive gray. During the breeding season, Sacramento splittail fins are tinged with red-orange and males become a darker color (Moyle 2002).	
other physical adult descriptors	Unique physical features for easy identification.	<p>Sacramento splittail have a distinctive tail (Moyle 2002).</p> <p>The upper lobe of the caudal fin on a Sacramento splittail is larger than the lower lobe (U.S.Fish and Wildlife Service 1995).</p>	

Element	Element Descriptor	General	Feather River Specific
adult food base	Indicate primary diet components.	<p>Sacramento splittail feed on bottom invertebrates in areas of low to moderate currents, and on earthworms in flooded areas (Moyle 2002).</p> <p>Detrital material makes up a high percentage of the stomach contents of Sacramento splittail (Moyle 2002).</p> <p>In the Suisun Marsh, Sacramento splittail forage extensively on opossum shrimp, benthic amphipods, and harpacticoid copepods. In the Delta, Sacramento splittail feed opportunistically on clams, crustaceans, insect larvae, and other invertebrates (Moyle 2002).</p> <p>Sacramento splittail feed extensively on opossum shrimp and detrital material, and feed opportunistically on earthworms, clams, insect larvae, and other invertebrates (U.S. Fish and Wildlife Service 1995).</p>	
adult feeding habits	Indicate whether plankton eater, algae eater, bottom feeder, piscivorous, active hunter, ambush predator, filter feeder. Night, day, dusk or dawn feeder.	<p>Sacramento splittail are diurnal feeders, with the most intense feeding occurring in the early morning (Moyle 2002).</p> <p>Sacramento splittail are benthic foragers (Meng et al. 1995).</p>	
adult in-ocean residence time	For anadromous species, age when they migrate to the ocean and duration spent in the ocean before returning to freshwater to spawn.	N/A	

Element	Element Descriptor	General	Feather River Specific
adult habitat characteristics in-ocean	For anadromous species, description of the ocean habitat utilized: whether along major current systems, gyres, pelagic (beyond continental shelves) and neritic (above continental shelves) zones, etc.	N/A	
Adult upstream migration (immigration)			
range of adult upstream migration timing	Time of year adults migrate upstream. If applicable, indicate for various runs.	<p>Adult Sacramento splittail show gradual upstream movement during the winter and spring months to forage and spawn in flooded areas (Moyle 2002).</p> <p>Studies indicate that Sacramento splittail migrate upriver to spawn in freshwater from January through April (Meng et al. 1995).</p> <p>Adult Sacramento splittail undertake an annual upstream spawning migration from the estuary in late autumn and winter (Sommer et al. 1997).</p>	
peak adult upstream migration timing	Time of year most adults migrate upstream. If applicable, indicate for various runs.	N/A	
adult upstream migration water temperature tolerance	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	N/A	
adult upstream migration water temperature preference	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental.	N/A	
Adult holding (freshwater residence)			
water temperature tolerance for holding adults	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	Sacramento splittail are typically found in temperatures between 41°F and 75.2°F (5°C and 24°C). However, fish	

Element	Element Descriptor	General	Feather River Specific
		<p>acclimated to higher temperatures [84.2°F to 91.4°F (29°C to 33°C)] can survive rapid changes in water temperature for short periods of time (Moyle 2002).</p> <p>In laboratory studies conducted at the University of California at Davis, mean critical thermal minima (CT_{min}) and maxima (CT_{max}) for age-2 fish was 44.6°F and 84.2°F (7.0°C and 29.0°C), respectively (Young et al. 1996).</p>	
water temperature preference for holding adults	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental.	<p>Sacramento splittail are typically found in water temperatures between 41°F and 75.2°F (5°C and 24°C) (Moyle 2002).</p> <p>In laboratory studies conducted at the University of California at Davis, the final water temperature preference for age-2 fish was 66.2°F (19°C) (Young et al. 1996).</p>	
water depth range for holding adults	Reported range of observed (minimum and maximum) water depth utilization.		
water depth preference for holding adults	Reported range of most frequently observed water depth utilization.	Field studies indicate that Sacramento splittail prefer a shallow water habitat of less than or approximately 22 feet (6.7 meters) (Meng et al. 1995).	
substrate preference for holding adults	If bottom dwellers, indicate substrate: mud, sand, gravel, boulders, aquatic plant beds, etc. If gravel, indicate range or average size of gravel.	<p>Shallow dead-end sloughs of the marsh lined with tules and reeds provide rich feeding grounds and refuge from predators for Sacramento splittail (Meng et al. 1995).</p> <p>Flooded terrestrial habitat can provide abundant food for pre-spawning Sacramento splittail adults (Sommer et al. 1997).</p>	
water velocity range for holding adults	Reported range of observed (minimum and maximum) water velocity utilization.		

Element	Element Descriptor	General	Feather River Specific
water velocity preference for holding adults	Reported range of most frequently observed water velocity utilization.		
other habitat characteristics for holding adults	General description of habitat (e.g. turbid or clear waters, lentic or lotic, presence of aquatic plant beds, debris, cover, etc.).	<p>Sacramento splittail prefer low-salinity, shallow-water habitats (Meng et al. 1995).</p> <p>Sacramento splittail are primarily freshwater fish, but are tolerant of moderate salinities and can live in water with salinities of 10 to 18 parts per thousand (U.S. Fish and Wildlife Service 1995).</p> <p>Sacramento splittail tend to be most abundant where other native fishes are abundant as well (U.S. Fish and Wildlife Service 1995).</p>	
timing range for adult holding	Time of year (earliest-latest) and duration of stay from upstream migration to spawning.	Sacramento splittail may migrate upstream to spawn (Meng et al. 1995).	
timing peak for adult holding	Time of year when maximum number of adults are present before spawning.	Sacramento splittail may migrate upstream to spawn (Meng et al. 1995).	
Spawning			
fecundity	Average or range in the number of eggs females lay in a spawning season.	<p>Sacramento splittail typically lay between 5,000 and 100,800 eggs (Wang 1986).</p> <p>The largest Sacramento splittail females can lay over 100,000 eggs (Moyle 2002).</p> <p>Of 20 sampled Sacramento splittail over 6.9 inches (175 millimeters) in length, fecundity ranged from 17,500 to 266,000 eggs (Daniels et al. 1983).</p>	
nest construction	Location and general description of nest -- substrates, aquatic plants, excavations, crevices, habitat types, etc.	Sacramento splittail construct nests in shallow, weedy areas (Wang 1986).	

Element	Element Descriptor	General	Feather River Specific
nest size	Size and average dimensions of the nest.	N/A	
spawning process	Indicate whether nest builder, broadcast spawner, or other.	Fertilized eggs stick to submerged vegetation and debris until hatching (Moyle 2002).	
spawning substrate size/characteristics	Range of substrates used during spawning (e.g. mud, sand, gravel, boulders, beds of aquatic plants). Indicate presence of plant/wood debris, crevices at spawning sites. If gravel, indicate range of average size.	<p>Sacramento splittail spawn in flooded river beds and in areas with submerged vegetation (Wang 1986).</p> <p>It is possible that Sacramento splittail spawn on vegetation (Daniels et al. 1983).</p> <p>Sacramento splittail spawn on submerged vegetation in flooded areas (U.S. Fish and Wildlife Service 1995).</p>	
preferred spawning substrate	Indicate preferred spawning substrate (e.g. mud, sand, gravel, boulders, plant bed, etc).	<p>Sacramento splittail prefer to spawn in areas of flooded vegetation (Moyle 2002).</p> <p>Sacramento splittail prefer to spawn in areas having aquatic vegetation, in streams or river beds, and along banks (Caywood 1974).</p>	
water temperature tolerance for spawning	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	The onset of Sacramento splittail spawning seems to be associated with increasing water temperature [to 57.2°F to 66.2°F (14°C to 19°C)] (Moyle 2002).	
water temperature preference for spawning	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.	Sacramento splittail prefer to spawn in water temperatures ranging from 48.2°F to 68°F (9°C to 20°C) (Caywood 1974).	
water velocity range for spawning	Minimum and maximum speed of water current the spawning fish can tolerate.	Successful reproduction of Sacramento splittail is strongly associated with high outflows preceding, during, and following spawning (U.S. Fish and Wildlife Service 1995).	

Element	Element Descriptor	General	Feather River Specific
water velocity preference for spawning	Preferred water current (flow velocity) during spawning.		
water depth range for spawning	Reported range of observed (minimum and maximum) water depth utilization.		
water depth preference for spawning	Reported range of most frequently observed water depth utilization.		
range for spawning timing	Earliest and latest time of season or year in which spawning occurs.	<p>Sacramento splittail spawning can occur anytime from late February to early July (Moyle 2002).</p> <p>Sacramento splittail spawning occurs from late April to early May in the marsh (Daniels et al. 1983).</p> <p>The onset of Sacramento splittail spawning seems to be associated with increasing water temperature and day length, and occurs between early March and May in the upper Delta (U.S. Fish and Wildlife Service 1995).</p> <p>In the tidal freshwater and euryhaline habitats of the Sacramento-San Joaquin estuary, Sacramento splittail spawning occurs by late January and early February and continues through July (U.S. Fish and Wildlife Service 1995).</p>	
peak spawning timing	Time of year most fish start to spawn.	The most frequent Sacramento splittail spawning occurs in March and April (Moyle 2002).	
spawning frequency (iteroparous/semelparous)	<p>Semelparous - producing all offspring at one time, such as in most salmon. Usually these fish die after reproduction.</p> <p>Iteroparous - producing offspring in successive, e.g., annual or seasonal batches, as is the case in most fishes.</p>	<p>The Sacramento splittail is an opportunistic spawner (Wang 1986).</p> <p>The Sacramento splittail is an annual spawner (Daniels et al. 1983).</p> <p>Iteroparous.</p>	

Element	Element Descriptor	General	Feather River Specific
Incubation/early development			
egg characteristics	Shape, size, color, in clusters or individuals, stickiness, and other physical attributes.	Mature Sacramento splittail eggs are spherical, measuring 0.05 to 0.06 inches (1.3 - 1.6 millimeter) in length. The eggs are transparent, thick, and smooth, except at the adhering point (Wang 1986).	
water temperature tolerance for incubation	Range of water temperatures allowing survival. Indicate stressful or lethal levels.		
water temperature preference for incubation	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		
time required for incubation	Time duration from fertilization to hatching. Note: Indicate at which temperature range. Incubation time is temperature-dependent.	The time required for egg incubation is 3 to 7 days, depending on the water temperature (Moyle 2002).	
size of newly hatched larvae	Average size of newly hatched larvae.	Newly hatched Sacramento splittail larvae are less than 0.3 inches (6.5 millimeters) in length (Wang 1986). Sacramento splittail larvae are 0.3 to 0.31 inches (7 to 8 millimeters) in length at the completion of the yolk-sac stage (Wang 1986).	
time newly hatched larvae remain in gravel	Time of year of hatching, and duration between hatching and emergence from gravel.	N/A	
other characteristics of larvae	Alevin -- early life history phase just after hatching (larva) when yolk-sac still present.	The Sacramento splittail yolk sac is elongated; enlarged in thoracic region, and slender in abdominal region (Wang 1986).	
timing range for emergence	Time of year (earliest-latest) hatchlings (larvae and alevins) leave or emerge from the nesting/hatching (gravel) sites.	After hatching, Sacramento splittail larvae remain in shallow, weedy areas until the water recedes, and then they migrate downstream with the river flow (Meng et al. 1995).	

Element	Element Descriptor	General	Feather River Specific
timing peak for emergence	Time of year most hatchlings emerge.		
size at emergence from gravel	Average size of hatchlings at time of emergence.		
Juvenile rearing			
general rearing habitat and strategies	General description of freshwater environment and rearing behavior.		
water temperature tolerance for juvenile rearing	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	In a laboratory study on small age 0 to age 2 Sacramento splittail, the minimum water temperature tolerated was 44.1°F to 45.1°F (6.5°C to 7.3°C), while the maximum water temperature tolerated by juveniles was 68.9°F to 91.4°F (20.5°C–33.0°C), depending on the acclimated water temperature and age (Young et al. 1996).	
water temperature preference for juvenile rearing	Range of suitable, preferred, or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.	In laboratory studies, the preferred water temperature for small age 0 Sacramento splittail was 71.6°F to 75.2°F (22°C to 24°C), depending on acclimated water temperature. Preferred water temperature for large age 0 fish was 69.8°F to 77°F (21°C to 25°C), depending on acclimated water temperature. For age 1 juveniles, the preferred water temperature was 66.2°F (19°C) (Young et al. 1996).	
water velocity ranges for rearing juveniles	Reported range of observed (minimum and maximum) water velocity utilization.		
water velocities preferred by rearing juveniles	Reported range of most frequently observed water velocity utilization.		
water depth range for juvenile rearing	Reported range of observed (minimum and maximum) water depth utilization.	Juvenile Sacramento splittail prefer shallow-water habitat with emergent vegetation (i.e., tules and reeds) during	

Element	Element Descriptor	General	Feather River Specific
		rearing (Meng et al. 1995).	
water depth preference for juvenile rearing	Reported range of most frequently observed water depth utilization.		
cover preferences for rearing juveniles	Type of cover for protection from predators used by rearing juveniles (e.g. crevices, submerged aquatic vegetation, overhanging vegetation, substrate cover, undercover bank, small woody debris, large woody debris).		
food base of juveniles	Indicate primary diet components. Also indicate the diet changes, if any, as growth occurs.	The food base for juvenile Sacramento splittail is algae, pelecypods, and amphipods (Wang 1986).	
feeding habits of rearing juveniles	Indicate whether plankton eater, algae eater, bottom feeder, piscivorous, active hunter, ambush predator, filter feeder. Night, day, dusk or dawn feeder. Also indicate change of feeding habits growth occurs.	Juvenile Sacramento splittail are benthic foragers (U.S. Fish and Wildlife Service 1995).	
predation of juveniles	Indicate which species prey on juveniles.	Striped bass and other piscivorous fish prey on juvenile Sacramento splittail (Moyle 2002). Large pikeminnow and striped bass prey on juvenile Sacramento splittail (Wang 1986).	
timing range for juvenile rearing	Range of time of year (months) during which rearing occurs.	Young Sacramento splittail rear in upstream areas for a few weeks to a year or more (Sommer et al. 1997).	
timing peak for juvenile rearing	Time of year (months) during which most rearing occurs.		

Element	Element Descriptor	General	Feather River Specific
Juvenile emigration			
time spent in fresh water prior to emigrating	Duration (in years and/or months) from emergence to emigration to the ocean.		
water temperature tolerances during emigration	Range of water temperatures allowing survival. Indicate stressful or lethal levels.		
water temperature preferences during emigration	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		
emigration timing range	Time of year juveniles commence emigration and duration of emigration	Downstream movement of juvenile Sacramento splittail probably occurs between May and July (Meng et al. 1995). Young-of-year (YOY) Sacramento splittail are caught in the South Delta pumping plants in the greatest numbers from April through August, presumably when moving downstream into the estuary (Moyle 2002).	
emigration timing peak	Time of year most juveniles are emigrating.	N/A	
size range of juveniles during emigration	Minimum and maximum sizes (inches or mm) of emigrating juveniles. Indicate average size.	N/A	
factors associated with emigration	Pulse flows, water temperature changes, turbidity levels, photoperiod, etc.		
Other potential factors			
DO	Levels of dissolved oxygen in water expressed in mg/l tolerated by fish.	All sizes of Sacramento splittail can survive in water having less than 1 milligram per liter of dissolved oxygen (Moyle 2002). The tolerance levels of dissolved oxygen for Sacramento splittail are 0.6 to 1.3	

Element	Element Descriptor	General	Feather River Specific
		mg/L for all age groups (Young et al. 1996).	
pH	Alkalinity/acidity of water (expressed in pH) that fish can tolerate.		
turbidity	Indicate turbidity or state of water (e.g., clear water or presence of siltation or organic/inorganic matter in water) that fish can tolerate.		
factors contributing to mortality	e.g. fishing/angling mortality, drastic habitat alterations, unfavorable climatic changes, etc.	<p>In order of importance, factors contributing to the mortality of Sacramento splittail are: (1) reduction in valley floor habitats; (2) modification of spawning habitat; (3) changed estuarine hydraulics, especially reduced outflows; (4) climate variation; (5) toxic substances; (6) introduced species; and (7) exploitation (Moyle 2002).</p> <p>Sacramento splittail have disappeared from much of their native range because dams, diversions, and agricultural development have eliminated or drastically altered much of the lowland habitat these fish once occupied (U.S. Fish and Wildlife Service 1995).</p>	<p>Access to Sacramento splittail spawning areas or upstream habitat is now blocked by dams on large rivers such as Nimbus Dam on the American River and Oroville Dam on the Feather River (U.S. Fish and Wildlife Service 1995).</p> <p>Reportedly, there is a consensus among Sacramento splittail anglers that the fishery has declined since the completion of Folsom and Oroville dams (U.S. Fish and Wildlife Service 1995).</p>

References

- Caywood, M. L. 1974. Contributions to the Life History of the Splittail *Pogonichthys Macrolepidotus* (Ayres). M.S. thesis, California State University, Sacramento.
- Daniels, R. A. and P. B. Moyle. 1983. Life History of Splittail (*Cyprinidae: Pogonichthys Macrolepidotus*) in the Sacramento-San Joaquin Estuary. Fishery Bulletin 81:647-654.
- Meng, L. and P. B. Moyle. 1995. Status of Splittail in the Sacramento-San Joaquin Estuary. Transactions of the American Fisheries Society 124:538-549.
- Moyle, P. B. 2002. Inland Fishes of California. Berkeley: University of California Press.
- Sommer et al. 1997. Resilience of Splittail in the Sacramento-San Joaquin Estuary. Transactions of the American Fisheries Society 126:961-976.
- U.S. Fish and Wildlife Service. 1995. Sacramento-San Joaquin Delta Native Fishes Recovery Plan. Portland, Oregon: U.S. Fish and Wildlife Service.
- Wang, J. C. S. 1986. Fishes of the Sacramento-San Joaquin Estuary and Adjacent Waters, California: A Guide to the Early Life Histories. Report # Technical Report 9.
- Young, P. S. and J. J. Cech Jr. 1996. Environmental Tolerances and Requirements of Splittail. Transactions of the American Fisheries Society 125:664-678.